

CLAIMS

[1] A solid-state imaging device comprising a plurality of unit pixels which are two-dimensionally arranged,

5 wherein each of said unit pixels includes:

a photoelectric conversion part which converts incident light into electric charges;

a convex lens layer which is formed above said photoelectric conversion part, and through which the incident light is transmitted;

10 and

a concavo-convex lens layer which is formed on and around said lens layer, and which collects the incident light and outputs the incident light to said lens layer.

15 [2] The solid-state imaging device according to Claim 1,

wherein said lens layer includes a light-transmission film having a shape of concentric circles in which a ratio of a total line-width to a periodic width varies depending on a plurality of zones, each of which is obtained by dividing said light-transmission
20 film by a predetermined periodic width in an in-plane direction.

[3] The solid-state imaging device according to Claim 1,

wherein a refractive index of said lens layer is greater than a refractive index of said lens layer.

25 [4] The solid-state imaging device according to Claim 1, further comprising

a wavelength separation part which is formed above said photoelectric conversion part and through which light of a
30 predetermined wavelength range is transmitted,

wherein a thickness and a width of said lens layer are set to achieve a predetermined focal length for the light of the

predetermined wavelength range.

[5] The solid-state imaging device according to Claim 1,
wherein said lens layer is made of one of boron phosphorous
5 silicon glass, tetra ethoxy silane, benzocyclobutene, and polyimide
resin.

[6] The solid-state imaging device according to Claim 1,
wherein said lens layers have a part where said lens layers are
10 getting thinner from a center of said pixel towards a periphery of
said pixel.

[7] The solid-state imaging device according to Claim 1,
wherein said lens layer has a concentric shape whose center is
15 not immediately above a center of said photoelectric conversion
part.

[8] A method for manufacturing a solid-state imaging device
comprising a plurality of unit pixels which are two-dimensionally
20 arranged,

wherein each of the unit pixels includes:

a photoelectric conversion part which converts incident light
into electric charges;

a convex lens layer which is formed above the photoelectric
25 conversion part, and through which the incident light is transmitted;
and

a concavo-convex lens layer which is formed on and around
the lens layer, and which collects the incident light and outputs the
incident light to the lens layer,

30 said method comprising:

forming a material layer on a base in order to form the lens
layer;

forming a resist film on the material layer;

forming a pattern on the material layer in which a distance between the resist films is increased from a center of the pixel towards a periphery of the pixel;

5 etching the material layer up to a point where the material layer outside of said pattern still remains.

[9] A camera comprising a solid-state imaging device that includes a plurality of unit pixels which are two-dimensionally
10 arranged,

wherein each of said unit pixels includes:

a photoelectric conversion part which converts incident light into electric charges;

15 a convex lens layer which is formed above said photoelectric conversion part, and through which the incident light is transmitted; and

a concavo-convex lens layer which is formed on and around said lens layer, and which collects the incident light and outputs the incident light to said lens layer.

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